

OBJECTIVE 2.13 Identify factors that influence the stopping distance of a vehicle.

INTRODUCTION

The stopping distance is the distance measured from the moment the driver sees a reason to stop, point of perception, to the moment the vehicle stops. Three events must occur. The driver:

1. Identifies the reason for stopping
2. Physically reacts with pressure on the brake pedal
3. Brakes the vehicle to a stop

When the performance of one or more of these events is delayed, the stopping distance will be increased. This will lead to a greater potential for collision.

The stopping distance is influenced by three factors:

1. Driver
2. Environment
3. Vehicle

CONTENT

1. DRIVER

Driver-related factors which will increase the stopping distance include:

- a. Perception skills - Conscious observation of a problem, anticipation.
- b. Attitude - Desire, risk acceptance.
- c. Attention span - Distractions, concentration levels.
- d. Physical reaction capabilities - Coordination, braking method, body control.
- e. Physiological impairments - Eyesight, substance abuse, fatigue.
- f. Emotional control - Confidence, experience.

2. ENVIRONMENT

Environmental conditions which will increase the stopping distance are:

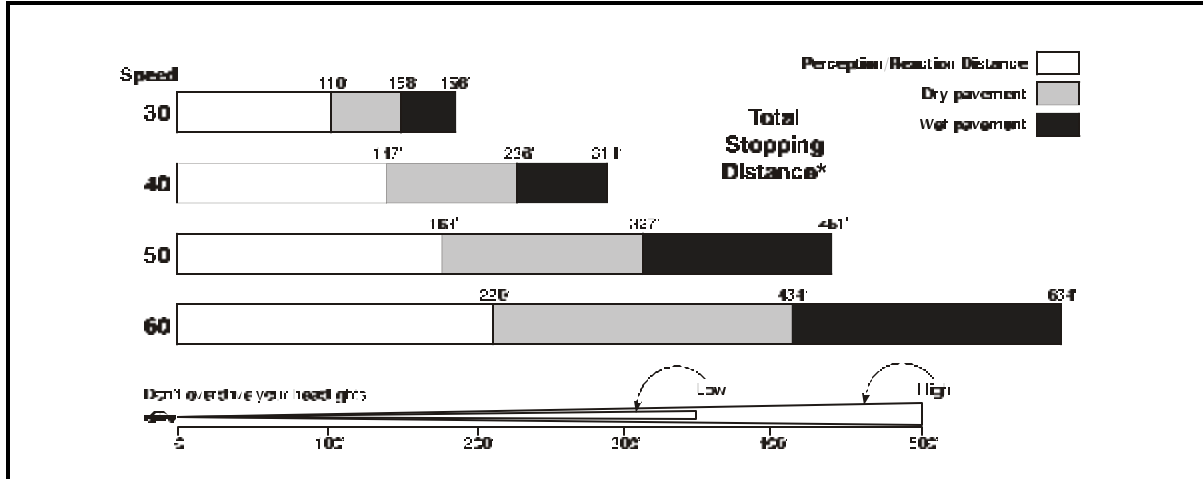
- a. Road surface - Wet, dry, surface debris, pavement type, and temperature.
- b. Road grade - Flat, uphill, downhill, curve, crowned, banked.
- c. Road type - Asphalt, concrete, gravel, dirt, etc.
- d. Visibility related to perception time - Weather conditions, day or night, blind spots, other traffic.

3. VEHICLE

Some aspects of the vehicle's capabilities or limitations plus a lack of maintenance can increase the stopping distance. These vehicle related factors that will effect the stopping distance include:

- a. Speed - This is the critical factor; the greater the speed, the more the distance required to bring the vehicle to a stop.
- b. Braking system - Poorly maintained, brake fade, low brake fluid.
- c. Suspension system and steering components: bad shock absorbers, tie rods.
- d. Tires: improper tire tread, improper tire pressure, alignment, ice studs.
- e. Vehicle weight and distribution of extra weight: uneven distribution, greater mass.

- 4. There is no total agreement as to what the exact stopping distances are for vehicles. Considering all of the variables, this is certainly understandable.
- 5. The following chart shows the stopping distances for various speeds. It is based on an alert driver searching ahead at an acceptable distance, reacting within the normal 3/4 seconds. The brakes are in good working order and the pavement is dry and level. These figures are averages. They show that stopping distances do not increase proportionately to the increase in speed.



ESTIMATING PERCEPTION AND REACTION TIME

In order to calculate the distance covered during perception and reaction time multiply the speed of the vehicle by 1.1. (This is .75 sec. x 1.467) For example: At a speed of 45 mph the distance is 49.5 feet ($45 \text{ mph} \times 1.1 = 49.5$). Since perception time is calculated at .75 seconds the distance covered during perception is equal to the distance traveled during reaction time or 49.5 feet. The total distance for perception and reaction can be determined by multiplying the speed by 2.2 ($45 \text{ mph} \times 2.2 = 99 \text{ feet}$).

SUMMARY

Memorizing stopping distances or being able to calculate the distances shouldn't be the goal of instruction. Recognition of the contributing factors and the fact that distances increase exponentially with increased speeds, along with the adopting of driving habits to counter the increase is what is important.

SUGGESTED INSTRUCTIONAL METHODOLOGY

LECTURE WITH DISCUSSION

List the factors which influence the stopping distance. Ask the class to identify what a driver should do to assure that each factor will be a positive, rather than negative, influence on the stopping distance. Emphasize the attitudes and willingness necessary to make changes in habits and skills.

LECTURE WITH CASE STUDY

Using collision investigation reports, create realistic case conditions and have the students determine what the stopping distances would be. Vary the weight and speeds of the vehicles, traction conditions, and driver capabilities.

RANGE

Using the practice driving range, have the students accelerate to specific speeds and, given a verbal cue, activate the brakes to create the shortest stopping distance. Comparisons can be made for each student as speeds are increased. Then, change the traction conditions or tire conditions for each additional effect.

ON THE STREET

Have the students drive through a variety of traffic conditions. The students are allowed to compare the feeling they experience of the stopping control while staying perceptive at least 12 seconds ahead of the vehicle compared to less than 6 seconds ahead, the average for untrained drivers.

RESOURCES AND AIDS

1. Acceptable physics textbooks
2. Driver training textbooks
3. Acceptable collision investigation textbooks

SUGGESTED EVALUATION METHODOLOGY**STUDENTS**

1. Written or verbal responses to questions regarding stopping distance-related problems
2. Observation of proper searching and perceptual skills
3. Observation of physical reaction and coordination skills
4. Observation of acceptable braking techniques

COURSE

Research collision records for incidents involving failure to stop. Determine the conditions and circumstances surrounding the collision.